WHAT IS CLAIMED IS:

1. A method for determining the level of the contents in a container comprising:

interrogating a container with ultrasound with one or more ultrasonic transducers in acoustic contact with a sidewall of the container at a transducer location below the upper surface of the contents of the container;

receiving a first response to the interrogating with the one or more transducers corresponding to ultrasound reflected from an opposite sidewall of the container along an acoustic path through the liquid that is substantially independent of the height of the upper surface;

receiving a second response to the interrogating with the one or more transducers corresponding to ultrasound reflected from an intersection between the upper surface and a sidewall of the container; and

determining a value corresponding to height of the upper surface relative to the transducer location from the first and second responses.

2. The method of claim 1 wherein the interrogating includes sequentially:

a) interrogating along a generally horizontal axis; and

b) interrogating along at least one inclined axis.

3. The method of claim 2 wherein b) interrogating along at least one inclined axis includes interrogating along at least two non-parallel inclined axes.

4. The method of claim 2 wherein interrogating along at least one inclined axis includes producing an ultrasonic beam along at least one inclined axis having a divergence of between about 15 and 35 degrees in the contents of the container.

5. The method of claim 1 wherein the interrogating includes producing at least one ultrasound pulse having a pulse width less than about 2.0 centimeters in the contents of the container.

6. The method of claim 5 wherein receiving the second response includes receiving a time series corresponding to ultrasound pulses reflected from the intersection of the upper surface and a sidewall of the container.

7. The method of claim 1 further:

repeating the interrogating and receiving to determine a time series of values corresponding to the height; and

determining fill level based on a weighted average of the time series.

8. The method of claim 1 wherein the interrogating includes transmitting an ultrasound signal having encoded information, the method further comprising cross-correlating at least one of the received first and second responses with the transmitted ultrasound signal to determine time-of-flight of the ultrasound along at least one acoustic path through the contents of the container.

9. The method of claim 8 wherein ultrasound having different encoded information is transmitted in different directions.

10. The method of claim 1 wherein the one or more ultrasonic transducers includes a multi-element transducer, the multi-element transducer including a plurality of transducer elements contained in a common housing wherein the plurality of transducer elements are adapted to transmit ultrasound in different non-parallel directions and wherein the interrogating includes sequentially transmitting ultrasound in the different directions with the plurality of transducer elements.

11. The method of claim 10 wherein the value corresponding to the height of the upper surface is determined from a known horizontal dimension of the container, a determined value corresponding to an ultrasound time-of-flight, and a determined value corresponding to a number of intermediate sidewall reflections of received ultrasound.

12. The method of claim 1 wherein the interrogation occurs at a frequency of less than about 20 kHz.

13. The method of claim 1 further comprising mechanically coupling the one or more transducers to the exterior of the container.

14. The method of claim 13 wherein the transducers are fastened to the container after the container is filled with a liquid.

15. The method of claim 14 further comprising removing the one or more transducers and monitoring the level of a different container with the transducers.

16. The method of claim 13 wherein the transducers are integrally formed with a sidewall of the container prior to the container being filled with a liquid.

17. The method of claim 1 further comprising displaying an indication of a determined liquid level in human readable form.

18. The method of claim 1 further comprising transmitting determined fill level information to a remote location.

19. The method of claim 1 wherein the first and second responses are received by different ones of a plurality of transducer elements contained in a common housing.

20. A system comprising:

one or more ultrasound transducers acoustically associated with a sidewall of a container at a first location below the upper surface of a liquid in the container, wherein the one or more transducers are positioned to interrogate the liquid with ultrasound and to receive at least a first and second response to the interrogating, the first response corresponding to ultrasound reflected from an opposite sidewall along a generally horizontal acoustic path through the liquid, the second response corresponding to ultrasound reflected from an intersection between the upper liquid surface and a sidewall of the container along a generally inclined acoustic path through the liquid; and

a processing device receiving signals from the transducers corresponding to the first and second responses and programmed to determine a value corresponding to height of the upper liquid surface relative to the first location from the received signals.

21. The system of claim 20 wherein the one or more transducers includes a multi-element transducer, the multi-element transducer including a plurality of transducer elements contained in a common housing wherein the plurality of transducer elements are adapted to transmit ultrasound in different non-parallel directions.

22. The system of claim 21 wherein the multi-element transducer includes three or more transducer elements in the common housing adapted to transmit ultrasound in three different non-parallel directions.

23. The system of claim 22 wherein a transducer element adapted to transmit ultrasound in a generally horizontal direction through the fluid is above a transducer element adapted to transmit ultrasound in an inclined direction through the fluid.

24. The system of claim 21 wherein at least one transducer element in the multi-element transducer is operable to transmit ultrasound having a divergence of at least about 15 degrees in the liquid in an inclined direction for reflection from an interface between the upper liquid surface and a sidewall of the container.

25. The system of claim 20 wherein the transducers are mounted to the exterior of the container.

26. The system of claim 25 wherein the container is substantially cylindrical.

27. The system of claim 20 wherein the processing device is programmed to determine fill level as a statistical aggregation of a series of fill level estimates

28. The system of claim 27 wherein the processing device is programmed to weight the series of fill level estimates based on one or more of signal to noise ratio and time.

29. A system comprising:

a housing containing a plurality of ultrasound transducer elements wherein the housing is adapted to be acoustically coupled to an exterior sidewall of a fluid container with the transducer elements in acoustic communication with the interior of the container;

wherein, when the housing is acoustically coupled to the exterior sidewall of the fluid container at a housing location below an upper liquid surface of liquid in the container, a first transducer element is operable to transmit and receive ultrasound in a

generally horizontal direction and at least one second transducer element is operable to transmit and receive ultrasound in a generally inclined direction; and

a processing device in communication with the first and second transducer elements configured to receive outputs therefrom and to determine a value corresponding to height of the upper liquid surface above the housing location from values corresponding to first and second ultrasonic times-of-flight, the first ultrasonic time-of-flight being of ultrasound reflected from an opposite sidewall of the container and the second time-of-flight being of ultrasound reflected from the intersection between the upper liquid surface and a sidewall of the container.

30. A method for determining the level of liquid in a container comprising:

determining a first value corresponding to a first ultrasonic time-of-flight for ultrasound that travels along a generally horizontally acoustic path through the liquid;

determining a second value corresponding to an ultrasonic time-of-flight for ultrasound that travels along an inclined acoustic path through the liquid, reflects from an intersection between an upper liquid surface and a sidewall of the container, and is received at a first location below the upper liquid surface;

from the first and second values, determining a third value corresponding to a height of the upper liquid surface relative to the first location.

31. A method for determining the level of liquid in a container comprising:

interrogating a container of liquid with ultrasound with an interrogation device in acoustic contact with the liquid at a first location below an upper surface of the liquid;

receiving a response to the interrogating,

from the received response, determining a first value corresponding to an ultrasonic time-of-flight for an acoustic path between the first location and an intersection between the upper liquid surface and a sidewall of the container;

determining a value corresponding to a relative height of the upper surface of the liquid from the first value.

32. A system comprising:

a housing containing at least first and second ultrasound transducer elements operable to receive ultrasound propagating in first and second different direction wherein the housing is adapted to be acoustically coupled to an exterior sidewall of a container with the transducer elements in acoustic communication with the interior of the container; and

a processing device in communication with the first and second transducer elements for receiving outputs therefrom;

the processing device including programming instructions to determine a second value corresponding to an ultrasonic time-of-flight for an acoustic path between the second transducer element and an intersection between the liquid surface

and a sidewall of the container and to determine a relative height of a liquid surface in the container from the second value and a first value corresponding to a horizontal dimension of the container.

33. The system of claim 32 wherein the processing device includes programming instructions to determine the first value corresponding to a horizontal dimension of the container from an ultrasonic time-of-flight measured with the first transducer element.

34. A fill level monitoring apparatus adapted to monitor the height of contents in a container comprising:

ultrasound generating means, an ultrasonic receiver, and signal processing means adapted to receive signals from the receiver,

wherein the signal processing means is configured to identify a first signal corresponding to a first ultrasonic wave that has traveled through the contents of the container to the receiver independently of the height of the contents in the container, and a second signal corresponding to a second ultrasonic wave that has been reflected from an interface between the upper surface of the contents in the container, the environment above the contents, and a sidewall of the container, and

wherein the signal processing means uses the transit times for the two waves to provide an indication of the level of the contents in the container.